



Trans-Lake Washington Project

Trans-Lake Washington Tunnel Assessment

January 10, 2001



Washington State
Department of Transportation



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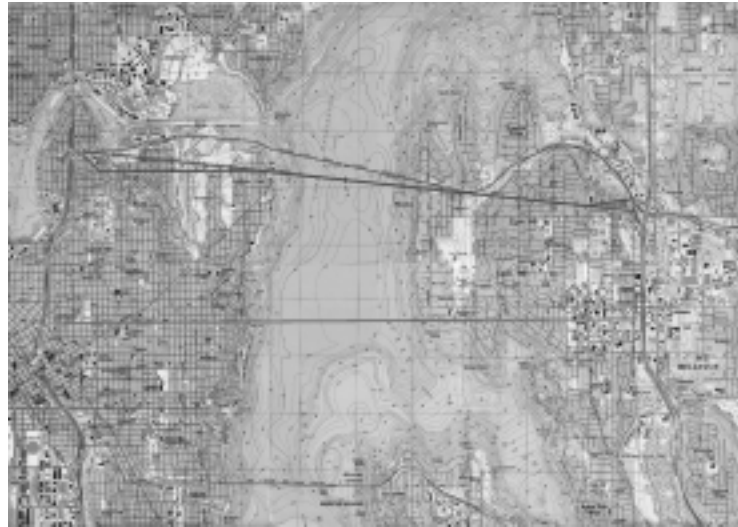
Tunnel Study Objectives

- Review considerations in the SR 520 corridor
- Develop tunnel concepts
- Develop cost data
- Committee validation of direction



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Plan of Lake Crossings



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Lake Section (1968 Report)



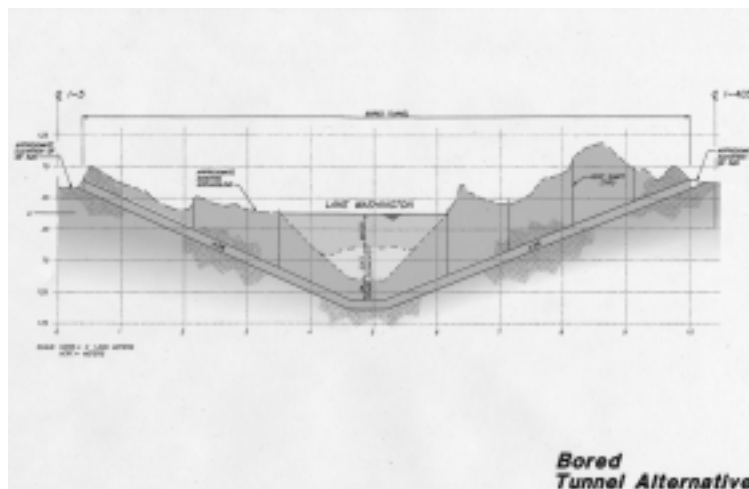


Bored Tunnel

- Located below the lake bottom
- Evaluate and compare concepts
- Largest diameter tunnel boring machines currently available ~50 feet
- All roadway options require at least two tunnel bores
- Connected by cross passages

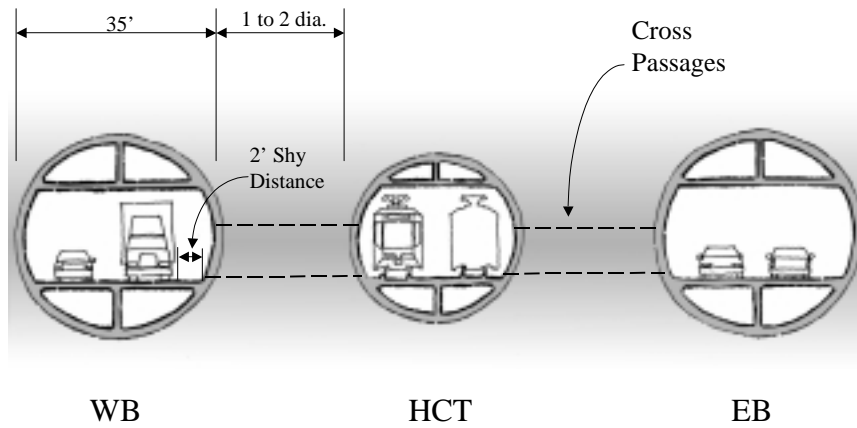


Bored Tunnel Profile

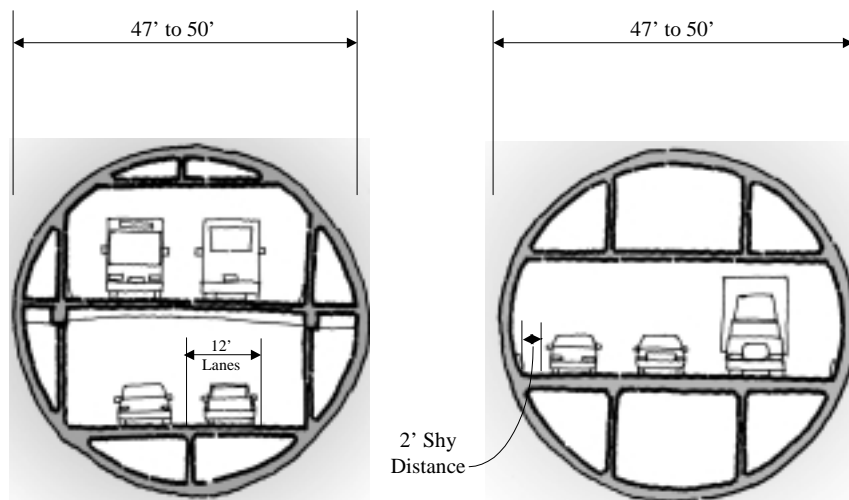




Bored Tunnels



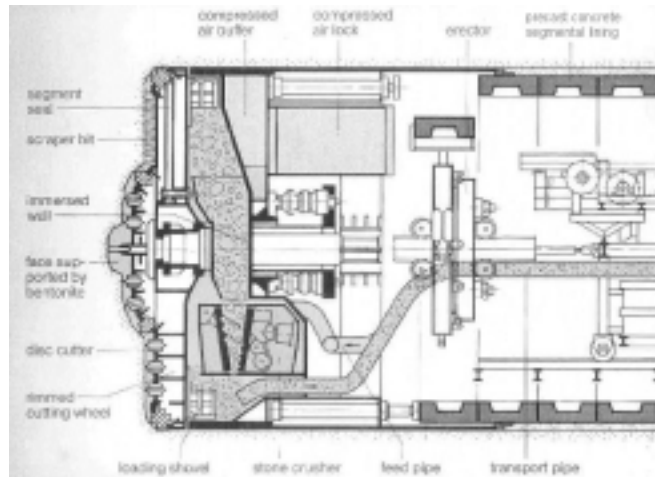
Large Bored Tunnels





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Tunnel Boring Machine



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Ventilation Structure





Bored Tunnel Considerations

- Truck traffic not recommended
- Ped-bike traffic not recommended
- No access to Montlake and Bellevue
- Shoulder width may be limited
- Technical viability pushes current limits
 - Geotechnical exploration needed
 - TBM manufacturer's input needed
 - Portal and interchange details
 - Ventilation shafts



Bored Tunnel Construction Cost

- Bored tunnel construction is expensive and risky
- 8-lanes I-5 to I-405 - \$5 to 6B
 - Tunnel construction costs only
 - Ventilation and cross passages included



Bored Tunnel Summary

- Long steep grades
 - Design standards
- Six miles long
 - Eliminates all connections between I-5 and I-405
- Pushes limits of technology
 - Need to study feasibility in great detail
- Geotechnical conditions unknown
- Unknown faults and permeable seams
- Most expensive of all options



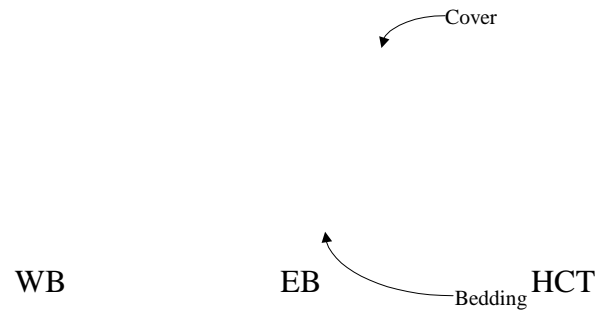
Sunken Submerged Tunnel

- Tunnel sections prefabricated
- Bed prepared on lake bottom
- Tunnel sections placed and joined
- Tunnel covered with protective rip rap



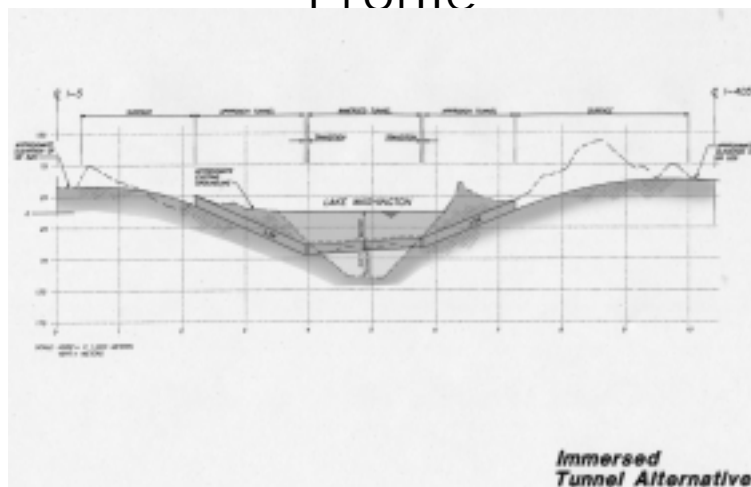
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Sunken Submerged Tunnels



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Sunken Submerged Tunnel Profile





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Sunken Submerged Tunnel Considerations

- Deeper than any existing tunnel
- Poor quality of bedding material
- Side slopes steep - about 15%
- Water to land transition at great depth
- May require multiple tunnels for transition to bored tunnels



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Sunken Submerged Tunnel Summary

- Transition requires technology beyond what has been done
- Costly bored or mined approaches
- Feasibility needs detailed study
- Questionable foundation material
- Expensive construction



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Submerged Floating Tunnel

- Tunnel sections fabricated off site
- Tunnel sections floated in, lowered and joined
- Tunnel anchored down or supported



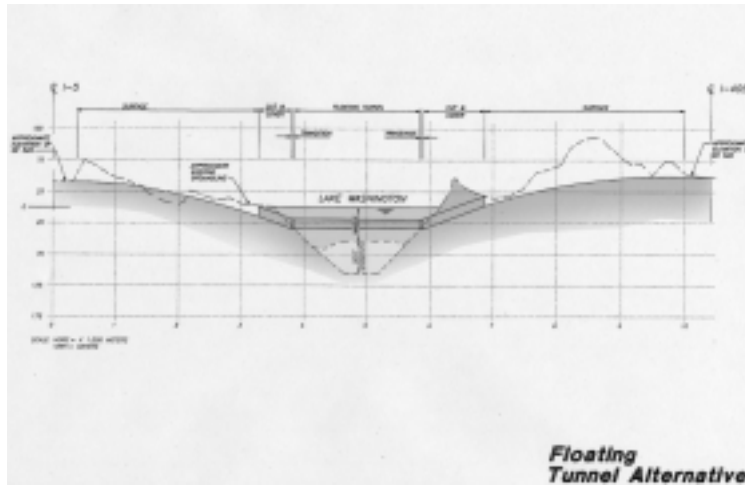
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Submerged Floating Tunnel



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Submerged Floating Tunnel Profile



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Cofferdam at Transition





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Artificial Island at Transition



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Submerged Floating Tunnel Considerations

- No floating tunnel built to date
- Advanced studies under way
- Required technology is available
- Safety issues need detailed study



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Submerged Sunken and Floating Tunnel Construction Cost

- About three to four times floating bridge construction cost
- Tunnel construction involves risk
- 8-lane crossing (tunnel construction only):
 - Submerged sunken tunnel \$2.5 to 3B
 - Submerged floating tunnel \$1.5 to 2.5B



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General Conclusion

- Tunnels are very expensive and risky
- Lake Washington options are at cutting edge of technology
- Portals and ventilation structures are significant undertakings
- Environmental impact issues require much more work



Bored Tunnel Conclusions

- Grade issue at upper limits
 - excludes truck traffic
- Eliminates all connections between I-5 and I-405
 - pushes extra traffic onto interstates
- Multiple bores may be required
- At the outer limit of current technology
- ~ 5 times the cost of floating bridge



Submerged Sunken Tunnel Conclusions

- Grades steep, but manageable
- Water-to-land transition at unprecedented depths
 - multiple tunnels may be required
- Some interchanges can't connect
 - local traffic implications
- Highly questionable bedding material
- ~4 times the cost of floating bridge



Submerged Floating Tunnel Conclusions

- Ideal from an application standpoint
- No FST in existence
- Water/land transition probably requires cut/cover sections
- ~3 times the cost of floating bridge



Team Recommendations

- Drop cross-lake tunnels in the SR 520 corridor from further consideration due to
 - Questionable technical feasibility
 - Marginal improvement in mobility
 - High levels of risk
 - Cost